

Shifting the Military Paradigm: Refining Strategy through Airpower Theory

A Monograph

by

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Abstract

Shifting the Military Paradigm: Refining Strategy through Airpower Theory, by Maj Matthew C. Wunderlich, USAF, 44 pages.

The advent of airpower in the early twentieth century forced changes to military strategy. Technological growth introduced aviation to the battlefield and mandated changes in warfare theory to account for airpower capabilities. Aviation innovations did not transform the character of warfare; instead, various military leaders envisioned this new domain's potential and shaped technology through airpower theory to improve military strategy.

The monograph's research question is how did airpower theorists Brigadier General William "Billy" Mitchell, General Henry H. "Hap" Arnold, Colonel John Boyd, and Colonel John Warden influence military strategy?

The monograph structure presents the four theorists' different backgrounds then analyzes how each individual affected military strategy through means, ways, and ends development. Analyzing trends across the four case studies clarifies the relationship between organizations, technology, and leadership as well as the steps necessary to integrate airpower into the US military.

These theorists influenced military strategy by leading technological transformation to expand capabilities and conditions to gain military advantages through airpower. Shifting military strategy required comprehensive means, ways, and ends development by each airpower theorist. These developments included organizational changes in the military, expanded technological capabilities to exploit asymmetric advantages, and leadership practices to embrace disruptive innovations in the emerging domain.

The monograph recommends organizational change, doctrinal reframing, and end state expansion as necessary elements for shifting military strategy with the advent of a new domain.

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Acronyms

| | |
|-------|-------------------------------|
| ADP | Army Doctrinal Publication |
| AWPD | Air War Plans Division |
| DoD | Department of Defense |
| FM | Field Manual |
| JP | Joint Publication |
| OODA | Observe, Orient, Decide, Act |
| USAAF | United States Army Air Forces |
| USAF | United States Air Force |

Chapter 1: Introduction

The reasonable man adapts himself to the world; the unreasonable man persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man.

—George Bernard Shaw, *Man and Superman*

The advent of the airplane in the early twentieth century fundamentally changed military operations by introducing a new domain and a series of capabilities to the operational environment. Alongside the innovative technologies inherent to aviation came varied theories regarding airpower's role supporting and conducting operations within warfare to achieve political objectives. Airpower theorists challenged existing models for force employment, called military paradigms, seeking to gain asymmetric advantages in warfare. The air domain introduced complexities into the art and science of warfare requiring changes to the capabilities inherent to the military instrument of national power. Clarifying the relationship between twentieth-century airpower theorists, the nature of aviation technology, and the resultant impacts on military strategy improves understanding within military paradigms to derive trends in emerging domains.

This monograph explores the relationship between airpower theorists and military strategy. The research question the monograph sets out to answer is how did Brigadier General William "Billy" Mitchell, General Henry H. "Hap" Arnold, Colonel John Boyd, and Colonel John Warden influence strategy in the US military? Based on this research question, the working hypothesis is that these theorists influenced strategy by shifting prevailing thought in the US military toward airpower development and employment to increase the means, ways, and ends elements that comprise military strategy. This qualitative comparison clarifies the relationship between technological change, theory integration, and shifting military paradigms.

Articulating the complexities inherent to change, Thomas Kuhn's theoretical model for scientific revolution frames the relationship between theory, technology, and military strategy. This model structures the interaction between transformative theory and paradigmatic shifts. Thomas Kuhn was a physicist and historian who introduced the concept of shifting paradigms as

a byproduct of changes associated with the progress of knowledge. Kuhn's model for scientific revolution commences with normal science, introduces an anomaly, then either integrates the anomaly as a crisis or rejects the anomaly altogether. Eventually this process results in a paradigm shift as the crisis shapes new science.¹ The cyclical nature of Kuhn's model to explain shifting paradigms through scientific development makes it ideal for clarifying how the changes proposed by airpower theorists affected military strategy.

Prior to the advent of airpower in the twentieth century, the military paradigm included finite terrestrial and maritime boundaries that limited the application of military power. The capabilities, methods, and objectives within military strategy functioned within these boundaries. Utilizing Kuhn's model for scientific revolution as a framework for analysis, airpower represented an anomaly inside the military paradigm as technological developments shifted the boundaries of existing military strategies. Airpower theorists articulated changes to military capabilities, actions, and objectives with the intent of exploiting asymmetric military advantages and shifting existing military paradigms.

Billy Mitchell, Hap Arnold, John Boyd, and John Warden provide case studies to understand airpower theorists' impact on military strategy. These visionaries advocated for aviation-related anomalies including technological innovations, novel rearrangements of military capabilities, and fundamental changes to military operations that disturbed existing military paradigms. Analyzing the airpower theorist case studies through Kuhn's model exhibits the challenges inherent to change when faced with an anomaly, as the potential for both positive and negative consequences exist. Billy Mitchell, Hap Arnold, John Boyd, and John Warden leveraged innovative airpower theories to refine military capabilities and shift military paradigms with profound effects on the military instrument of national power.

¹ Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 3rd ed. (Chicago, IL: The University of Chicago Press, 1996), 92-110.

As early aviation visionaries, Mitchell, Arnold, Boyd, and Warden advocated for airpower theories informed by their individual and organizational history, as well as contemporary aviation technology, to develop new approaches to warfare. Technology relates to warfare, as both are linked processes for manipulating the physical world to achieve objectives. Whereas technology bends the material world, warfare seeks to alter human behavior by leveraging technology.² Within Kuhn's theoretical model, shifting the military paradigm required developing aviation means, then generating ways for airpower application, and finally articulating ends achievable through military power. Each airpower theorist developed means, ways, and ends differently in order to refine US military strategy and ultimately shift contemporary military paradigms.

To understand how these theorists influenced America's airpower capabilities necessitates qualitatively evaluating each case study against three criteria required for generating military strategy and shifting an existing paradigm. These criteria are the development of aviation means, operational ways, and strategic ends. The first criterion assesses how each theorist sought to employ technological developments and establish airpower capabilities. The second criterion, operational ways development, describes the methods and processes each theorist articulated to leverage airpower means. The final criterion, generating strategic ends, gauges how each theorist expanded the boundaries of objectives for the US military. Measuring the case studies against these three criteria frames the relationship between theory and military strategy in order to evaluate the working hypothesis and answer the research question.

Divided into four chapters, this monograph identifies the relationship between airpower theory and military strategy through a qualitative comparison. This first chapter introduces the content and presents the methodology. The second chapter articulates the key terms of airpower theory, military strategy, and disruptive innovation in order to frame essential concepts used

² Alex Roland, *War and Technology* (Oxford: Oxford University Press, 2016), 3.

throughout the monograph. The third chapter presents the four case studies against the three evaluation criteria. The case studies include Billy Mitchell's theory of an independent Air Force, Hap Arnold's theory of massed aviation, John Boyd's theories on relative maneuver, and John Warden's strategic effects theory. The fourth chapter analyzes continuities and contingencies within the four case studies to derive trends relating the airpower theorists to military strategy in order to evaluate the working hypothesis and answer the research question.

Chapter 2: Key Terms

Clarifying the concepts of airpower theory, military strategy, and disruptive innovation, provides the foundation for answering the research question of how Billy Mitchell, Hap Arnold, John Boyd, and John Warden influenced military strategy. A common lexicon clarifies the interaction within the four case studies between the theorist, the technology, and the resultant doctrine indicative of strategic changes. Understanding these key terms provides the framework for analyzing the case studies to derive the relationship between these airpower theorists and military strategy development.

The first key term in this monograph is airpower theory. According to Air Force doctrine, airpower is the ability to project military power or influence through the control and exploitation of the air domain to achieve objectives.³ The air domain, per Joint doctrine, begins at the earth's surface and extends to the atmosphere.⁴ This expansion into a new domain forced a different approach to military operations in the twentieth century. The concept of airpower and the subsequent requirement to understand the changes in military operations mandated the development of airpower-oriented theory, or understanding of emergent phenomena, alongside emergent capabilities.⁵ Therefore, airpower theory explains phenomena in the air domain that include power projection, influence, control, and exploitation expressed as military effects employed to achieve objectives.

The second key term used in this monograph is military strategy. While numerous definitions for strategy exist, this monograph adopts the Joint doctrine definition for strategy as “a prudent idea or set of ideas for employing the instruments of national power in a synchronized

³ US Department of the Air Force, *Air Force Doctrine Volume 1, Air Force Basic Doctrine* (Washington, DC: Government Printing Office, 2015), 1.

⁴ US Department of Defense, Joint Staff, *Joint Publication (JP) 3-30, Command and Control of Joint Operations* (Washington, DC: Government Printing Office, 2014), 119.

⁵ *Webster's Third New International Dictionary, Unabridged* (Springfield: Merriam-Webster, Inc., 1981), 666.

and integrated fashion to achieve theater, national, and/or multinational objectives.”⁶ While varying scales of strategy exist including grand strategy and national strategy, this monograph scopes analysis to airpower as a component of military strategy. Within this framework, military strategy cohesively links military resources and actions to desired objectives. The three main elements within military strategy are means, ways, and ends. Theorists influence military strategy by altering the complex interaction between means, ways, and ends through a shift in the military paradigm.

The third key term used to frame the relationship between airpower theory, technology, and military strategy is disruptive innovation. Defining disruptive innovation requires dividing innovations into the two categories of sustaining and disruptive. Sustaining innovations generate improvements within an existing measure or trajectory. Because they operate in previously valued systems, sustaining innovations historically succeed without advocacy or leadership intervention as the technology simply improves previous capabilities.⁷ An example of a sustaining technology in the military is the transition from the US Army’s M2 Light Tank to the M3 Light Tank during World War II. While the newer variant provided vast improvement to the previous model, it merely reinforced the existing metrics expected from the previous version including protection and firepower; therefore, the improved M3 Light Tank sustained technological norms.⁸

Unlike sustaining innovations that preserve an existing value, disruptive innovations generate improved performance along a previously undervalued trajectory. The undervalued path that the innovation exploits likely results in unpredictable outcomes. Within Kuhn’s model for

⁶ US Department of Defense, Joint Staff, Joint Publication (JP) 1-02, Department of Defense Dictionary of Military and Associated Terms (Washington, DC: Government Printing Office, 2001), 518.

⁷ Terry C. Pierce, *Warfighting and Disruptive Technologies: Disguising Innovation* (New York: Frank Cass, 2004), 200.

⁸ Spencer Tuck, *Instruments of War: Weapons and Technologies that have Changed History* (Santa Barbara: ABC-CLIO, 2015), 42.

scientific revolution described in Chapter 1, disruptive innovations exhibit potential anomalies to the status quo as new capabilities and paradigms emerge. The challenge is for normal science to identify the disruptive innovation as an anomaly sufficient to shift an existing paradigm.

Inherent to disruptive innovation is the likelihood that the new trajectory taken by the technology and its application will under-perform an established approach.⁹ Despite this risk, disruptive innovation potentially provides asymmetric advantage on the battlefield. An example of disruptive innovation is the invention of the airplane.¹⁰ The airplane anomaly generated new capabilities, trajectories, and metrics unlike any vehicle or weapon prior to its existence, therein disrupting military art and science.

Disruptive innovation links to airpower theory due to the technologically oriented nature of aircraft development. Aviation's scientific breakthroughs in the early twentieth century were disruptive as they opened the air domain to military exploitation. Airpower theory embraced disruptive innovation to generate capability and gain an asymmetric advantage in warfare. Technology alone does not drive warfare transformation; instead, theorists and leaders must integrate technology into military strategy to initiate change and gain relative advantage. The case studies of Billy Mitchell, Hap Arnold, John Boyd, and John Warden demonstrate the challenges faced by airpower theorists in articulating the benefits inherent to aviation and technological change while seeking to optimize airpower employment and shape military strategy. In formulating how disruptive technologies could shape military means, these airpower theorists comprehensively reframed boundaries within military means, ways, and ends as paradigms shifted and new military strategies emerged.

The three key terms of airpower theory, military strategy, and disruptive innovation frame the essential concepts used throughout this monograph. Military strategy relates to

⁹ Pierce, *Warfighting and Disruptive Technologies*, 28.

¹⁰ John Warden, *Airpower Applied: US, NATO, and Israeli Combat Experience*, ed. John Olsen (Annapolis, MD: Naval Institute Press, 2017), 350.

airpower theory as it serves as the doctrinal expression resulting from how the theorist understood and advocated for disruptive innovations within aviation technology to adjust military means, ways, and ends. With the growing complexities of warfare during the early twentieth century to include the increased sizes of militaries and the growing dispersion of forces throughout an operational environment, the layering of the air domain onto military operations created significant challenges for military planning and execution. Billy Mitchell, Hap Arnold, John Boyd, and John Warden embraced these challenges by integrating airpower capabilities into military strategy.

Chapter 3: Airpower Theorist Case Studies

Answering the research question, how did Billy Mitchell, Hap Arnold, John Boyd, and John Warden influence US military strategy, requires extensive background analysis of these four individuals. As airpower evolved from the dawn of aviation in the early twentieth century to modern warfare in the twenty-first century, these visionaries leveraged emerging technology and fundamentally altered the role of airpower in warfare. Within Kuhn's model, each individual perceived airpower as an anomaly that required a shift in an existing military paradigm. Understanding how each theorist influenced military strategy requires comparison against the evaluation criteria of means, ways, and ends development. Each case study provides the individual's background followed by a qualitative comparison between the theorist and the evaluation criteria.

Brigadier General William "Billy" Mitchell

Brigadier General Billy Mitchell provides the first case study clarifying the impact of airpower theory on military strategy. The case study consists of Mitchell's history in the US Army and the formation of his airpower theory during aviation's advent during World War I and the interwar period preceding World War II. Understanding how history shaped Mitchell's early airpower theory for an independent air force necessitates comparing the case study against the three evaluation criteria of means, ways, and ends development.

Born in 1879, Billy Mitchell enlisted in the US Army in 1898 to serve in the Spanish-American War. Within three weeks of his arrival to Cuba, Mitchell's family connections earned him a lieutenant's commission.¹¹ After service in Cuba and the Philippines, Mitchell became the youngest Captain in the United States Army and entered the Signal Corps.¹² As a Signal Corps

¹¹ Alfred F. Hurley, *Billy Mitchell, Crusader for Air Power* (Bloomington: Indiana University Press, 1975), 3.

¹² David R. Mets, *The Air Campaign: John Warden and the Classical Airpower Theorists* (Maxwell AFB, AL: Air University Press, 2012), 31.

officer, Mitchell worked with numerous inventions – both sustaining and disruptive in nature – that were new to the early twentieth-century military. These included hot-air balloons, telecommunications, the dirigible, the camera, the automobile, and the airplane. Embracing technological innovation, Mitchell invented a horse-borne pack for carrying telegraph wire, lectured on the benefits of balloons for the Signal Corps, and authored his first article advocating the use of airpower via dirigibles in 1906.¹³

After attending the US Army's Command and General Staff College, Mitchell served on the Army's General Staff in Washington, DC where he developed political and senior military contacts while witnessing the integration of early aviation capabilities into the American military. Following his tour with the General Staff, Mitchell was promoted to Major, paid his way through civilian flight training, then entered into the Aviation Branch of the US Army.¹⁴ Mitchell arrived in Europe eight days after President Wilson declared war in 1917, where he engaged with British and French aviators to refine his understanding of aviation capabilities. At the start of World War I, the United States had only twenty-eight planes compared to the French with 400 planes, the Germans with 400 planes, Russia with 300 planes, and Italy with 200 planes.¹⁵ Establishing himself as the foremost American aviation authority in the war, Mitchell advocated for increased aviation acquisition and developed his understanding of the role of airpower relative to land and naval forces.¹⁶

When Major General John Pershing arrived in Paris to command American forces on June 13, 1917, Mitchell was the foremost American aviation expert in Europe.¹⁷ Mitchell offered

¹³ Hurley, *Billy Mitchell*, 11.

¹⁴ *Ibid.*, 21.

¹⁵ Roger Burlingame, *General Billy Mitchell, Champion of Air Defense* (New York: McGraw-Hill Book Company, Inc., 1952), 61.

¹⁶ William Mitchell, *Winged Defense* (Tuscaloosa: University of Alabama Press, 1925), 8.

¹⁷ Hurley, *Billy Mitchell*, 29.

Pershing his ideas of strategic strike accomplished through embedded aviation elements at Division, Corps, and Army levels.¹⁸ Despite Mitchell's recommendations, Pershing did not focus on strategic airpower attacks, although he did create an Air Division utilizing Mitchell as his air advisor. Mitchell's defining operational moment in World War I was at the Battle of St.-Mihiel when 1,481 Allied aircraft supported an American ground operation with Mitchell acting as the overall force commander. During the battle, Allied aircraft gained air superiority over the 234 German aircraft and effectively supported the ground operation, while earning Mitchell promotion to Brigadier General.¹⁹

Less than a month after the Battle of St.-Mihiel, World War I ended with an armistice. After returning to the United States, Mitchell continued to refine his airpower theory advocating for an independent air force. Mitchell grew convinced that the United States needed an entirely revised defense structure to exploit airpower based on the assumption that geographic isolation as a defense could no longer be true in the aviation age. Mitchell believed that future military operations on land and sea required command of the air by an independent and centralized air force, freed from organizational constraints inherent to the US Army and Navy.²⁰

In addition to the requirement for an independent air force, Mitchell advocated for airpower's unique strategic effects. In his memoirs, Mitchell wrote that the "old theory that victory meant the destruction of the hostile main army is untenable."²¹ Mitchell believed airpower could strategically paralyze the enemy by striking deep into enemy territory.²² Mitchell argued that aircraft would encounter an enemy prior to ground force engagement and should therefore

¹⁸ Mitchell, *Winged Defense*, 21.

¹⁹ Hurley, *Billy Mitchell*, 36.

²⁰ Mitchell, *Winged Defense*, xv.

²¹ William Mitchell, *Skyways* (Philadelphia: J.B. Lippincott Company, 1930), 255.

²² *Ibid.*, 255.

gain a service equal to land and maritime forces. Through deep strike operations, an independent air force could wage decisive and rapid warfare to achieve military effects unlike any previous military precedent.²³

Mitchell tested his theory that the airplane had superiority over the battleship in 1920 with the sinking of the *Ostfriesland*.²⁴ While the US Navy protested the experiment and its findings, Mitchell's highly publicized event resulted in direct action by the Joint Board to renew aviation development.²⁵ This demonstration fed Mitchell's continued advocacy for aviation primacy when, in 1923, Mitchell authored a manual on aerial bombardment articulating his independent airpower theory alongside the moral effects of strategic strike.²⁶ Mitchell sought resources and missions from both the US Army and the US Navy to support these strategic changes to America's military organizations.

In 1924, Mitchell returned to Washington where his continued advocacy for an independent air force ended his career due to insubordination. Mitchell's repeated failure to obey his military chain of command and civilian leadership resulted in his court-martial in 1925. Following the court-martial, Mitchell resigned from the US military while continuing to argue for airpower concepts for nearly a decade until his death in 1936.²⁷ Mitchell's disobedience contributed to the end of his military and political aspirations. Despite these setbacks, Mitchell's airpower theory and ideas on military transformation ideas proved vital for the American military during the interwar period approaching World War II.

²³ Mitchell, *Winged Defense*, xvi.

²⁴ Hurley, *Billy Mitchell*, 64.

²⁵ Mitchell, *Winged Defense*, xvi.

²⁶ Hurley, *Billy Mitchell*, 82.

²⁷ *Ibid.*, 106.

Billy Mitchell's history and airpower theory provides the background necessary for qualitatively comparing this case study against the evaluation criteria of means, ways, and ends development. While Mitchell did not witness an independent American air force during his lifetime, his airpower advocacy served as the foundation for the eventual creation of the United States Air Force (USAF) in 1947. Ten years after Mitchell's court-martial, his followers, including Hap Arnold, Tooev Spaatz, Jimmy Doolittle, and Ira Eaker, became leaders in the Army Air Corps and the early Air Force.²⁸ Mitchell also influenced independent air force doctrine worldwide such as in Germany where his translated theory and writings refined the Luftwaffe prior to World War II.²⁹ Mitchell's airpower theory shaped US military organizations leading into World War II and ultimately aided the creation of the independent USAF.

Billy Mitchell developed military means by nurturing aviation capabilities and integrating airpower into US military organizations during the interwar period. Mitchell shaped the early US Army Air Corps' organizational structure and engaged with American industries to influence aircraft design and procurement. Mitchell's primary focus following World War I became procuring four-engine high altitude bombers to enable deep strike operations.³⁰ Mitchell's ideas affected US Army operations as well as US naval prioritization during the interwar period with aircraft carrier development.³¹ When Mitchell oversaw the sinking of the *Ostfriesland*, he established a framework for America's early attack aviation capability during the interwar period. Mitchell's theory and leadership molded America's original air forces in both organization and materiel while providing the foundation for subsequent airpower capabilities.

²⁸ Burlingame, *General Billy Mitchell*, 179.

²⁹ Isaac D. Levine, *Mitchell, Pioneer of Air Power* (New York: Duell, Sloane and Pearce, 1946), 396.

³⁰ Mets, *The Air Campaign*, 41.

³¹ US Department of War, Field Manual (FM) 100-20, *Command and Employment of Air Power* (Washington, DC: Government Printing Office, 1943), 10.

Mitchell developed operational ways for the US military by influencing US Army aviation acquisition methods and operational doctrine. Mitchell shaped aircraft employment and design practices that enabled military bombardment capabilities leading into World War II. Mitchell's influence appeared through the US Army's newly codified air doctrine, Field Manual (FM) 100-20, *Command and Employment of Air Power*, in 1943. The FM recommended sortie prioritization in favor of air interdiction prior to close air support as one of many guidelines espoused by Mitchell. The US Army's Air Corps Tactical School adopted Mitchell's concepts into a comprehensive doctrine to employ strategic strike operations against an enemy's industrial web.³² With his guidance to employ airpower effects offensively through strategic strike and defensively through protection missions, Mitchell enabled operational ways development for the US military.

Billy Mitchell developed ends within military strategy by expanding target objectives through airpower. Understanding the potential for aviation to bypass terrestrial defenses and conduct deep strike operations, Mitchell advocated for the expanded abilities of airpower to achieve desired ends. These abilities included long-range bombers and deep strike missions to achieve strategic impacts. Mitchell employed these airpower capabilities to achieve previously unprecedented objectives. Mitchell's influence on strategic bombing acquisition, mission sets, targeting, and airpower leadership appeared at the outset of World War II. This influence manifested most overtly as America's initial military forces deployed to the Europe were the long-range bombers of the Eighth Air Force. The US military engaged the enemy through airpower long before ground engagement could occur.³³ Despite insubordinate methods for applying his theory, Mitchell definitively influenced both the US military and American policy-

³² David MacIsaac, *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press, 1986), 633.

³³ Mets, *The Air Campaign*, 45.

makers in demonstrating airpower's potential capabilities to expand strategic ends and alter the military paradigm.

Qualitatively comparing Mitchell's case study against the criteria of means, ways, and ends development demonstrates the impact this early theorist had on influencing US military strategy. Mitchell's advocacy for an independent air force laid the foundation for the eventual creation of the USAF in 1947. The US Army Air Corps Tactical School integrated Mitchell's theory into tactical capabilities as demonstrated by strategic targeting and doctrine leading into World War II. Mitchell's theories served as the foundation for airpower development ushering in America's earliest air force and airpower strategy. Billy Mitchell effectively shifted the military paradigm by advocating for airpower and expanding possibilities to achieve desired ends. Mitchell's early contributions to airpower positively influenced US military strategy and enabled the theory of General Henry H. "Hap" Arnold.

General Henry H. "Hap" Arnold

General Hap Arnold provides the second case study illustrating the impact of airpower theory on military strategy. After graduating from the United States Military Academy at West Point in 1907, Arnold served as an Infantry officer before joining the Aviation Division of the Army's Signal Corps in 1911.³⁴ As one of the military's first aviators, Arnold's pilot training instructors were Orville and Wilbur Wright.³⁵ With his early experiences in aviation, Arnold was one of the few US military pilots at the dawn of World War I.

After President Wilson declared America's entrance into World War I on April 2, 1917, Arnold reported to the War Department where he oversaw the creation of the American

³⁴ Bill Yenne, *Hap Arnold: The General who Invented the US Air Force* (Washington, DC: Regnery History, 2013), 18.

³⁵ Henry H. Arnold and Ira C. Eaker, *This Flying Game* (New York: Funk & Wagnall's Company, 1943), 24.

Expeditionary Force's Air Division.³⁶ Arnold received brevet promotion and became the youngest Colonel in the Army while at the War Department. Given America's nascent aircraft production industry as well as a lacking infrastructure to train aviators, the challenges facing Arnold in establishing an Air Corps were immense.³⁷ Overcoming these challenges, Arnold oversaw the development of the US Army Air Service and increased personnel from 1,200 in June 1917 to more than 195,000 by May 1918.³⁸ Hap Arnold's leadership enabled the US Army to provide trained personnel and assist the Allied air campaign in Europe during World War I.

Following World War I, Arnold remained an influential leader in the US Army Air Service by focusing on personnel development during the interwar period. Unlike Billy Mitchell's disruptive approach to aviation, Arnold operated within the US Army to develop airpower leaders alongside essential organizations such as the Air Corps Tactical School and the Air Service's headquarters. After Billy Mitchell's court-martial, Arnold lost influence within the newly created US Army Air Corps. Instead, Arnold articulated his airpower theory in numerous articles and aviation novels.³⁹ Arnold helped develop the aviation industry throughout the interwar period while becoming an executive founder of Pan American Airways, honing contacts with leading aeronautical engineers and businesses throughout the United States and Europe.⁴⁰

During the interwar period, Hap Arnold refined his understanding of airpower and established the significant infrastructure required for supporting an air force. In 1935, Arnold received brevet promotion to Brigadier General when he took command of the 1st Wing at March Field, California. This assignment required Arnold to establish training regiments while

³⁶ Dik Alan Daso, *Hap Arnold and the Evolution of American Airpower* (Washington, DC: Smithsonian Institute Press, 2000), 44.

³⁷ Arnold and Eaker, *This Flying Game*, 122.

³⁸ Yenne, *Hap Arnold*, 33.

³⁹ Daso, *Hap Arnold and the Evolution of American Airpower*, 114.

⁴⁰ Yenne, *Hap Arnold*, 51.

authorizing revised doctrine when his Wing received newly constructed B-10 and B-12 Bombers in place of obsolete biplanes.⁴¹ Despite developments in American aviation production following World War I, Arnold discovered that both British and German manufacturing far outpaced American capabilities as the world approached the burgeoning crisis in Europe.⁴²

Hap Arnold became the Chief of Staff of the US Army Air Corps in September 1938 and remained the Chief for the duration of World War II.⁴³ With the growing specter of Germany, America joined France and England in establishing production lines for mass aircraft production. In 1940, the Battle of Britain drove increased demands for aircraft and aviation strategy ahead of America's entrance into World War II.⁴⁴ Arnold oversaw the creation of the Air Corps Ferrying Command to support the Lend Lease Act supplying England and various partners with American aircraft while expanding America's industrial production as the role of airpower in World War II manifested in the skies over Britain.⁴⁵

Arnold led the newly authorized US Army Air Forces (USAAF) as it gained increased autonomy from the Army and preparations continued to modernize the US military ahead of America's entrance into World War II.⁴⁶ Arnold worked with subordinates including Tooey Spaatz and Ira Eaker in the Air War Plans Division (AWPD) to publish AWPD-1 in July 1941 specifying airpower strategic bombing doctrine. The subsequent AWPD-2, published in September 1941, captured Arnold's theory on aircraft production and industrial mobilization to

⁴¹ Herman S. Wolk, *Cataclysm: General Hap Arnold and the Defeat of Japan* (Denton: University of North Texas Press, 2010), 25.

⁴² Arnold and Eaker, *This Flying Game*, 291.

⁴³ Wolk, *Cataclysm*, 31.

⁴⁴ Arnold and Eaker, *This Flying Game*, 284.

⁴⁵ Yenne, *Hap Arnold*, 82.

⁴⁶ Henry H. Arnold, *Report of the Commanding General of the Army Air Forces to the Secretary of War* (Washington, DC: Government Printing Office, 1944), 75.

mass aviation, and achieved strategic effects.⁴⁷ Following Japan's attack on Pearl Harbor in December 1941, Arnold helped mobilize American industry to support the war efforts while continuing to shape US airpower theory and doctrine during World War II.

Throughout World War II, Hap Arnold shaped the USAAF's theory, capabilities, and doctrine to influence military strategy. In 1942, Arnold oversaw the production and distribution of more than sixty thousand aircraft as America's massed aviation capabilities manifested over battlefields in Europe, Africa, and Asia.⁴⁸ Working with air strategists from the Royal Air Force, Arnold approved the Combined Bomber Offensive to influence Germany through airpower. Arnold also supported power projection capabilities through research and development investments. The USAAF fielded the B-25 Mitchell aircraft, a long-range bomber, employed during Doolittle's Raid to strike the Japanese mainland.⁴⁹ Throughout the war, Arnold defended strategic bombing missions as well as continued investment in research and development. Arnold's focus in developing airpower means to transform warfare led to the production of the B-29 Superfortress as a platform for long-range power projection.⁵⁰

By 1944, more than 2.4 million personnel and 72,726 aircraft comprised the USAAF as it continued to mass forces in the European and Pacific Theaters.⁵¹ The Allies gradually gained air superiority over Germany, enabling conditions for the invasion into France while continuing the strategic bombing campaign throughout Europe.⁵² As the Allies gradually achieved objectives in

⁴⁷ Arnold, *Report of the Commanding General of the Army Air Forces to the Secretary of War*, 94.

⁴⁸ *Ibid.*, 8.

⁴⁹ *Ibid.*, 49.

⁵⁰ *Ibid.*, 64.

⁵¹ Yenne, *Hap Arnold*, 177.

⁵² Arnold, *Report of the Commanding General of the Army Air Forces to the Secretary of War*, 46.

the European Theater, Arnold reoriented USAAF resources in the Pacific.⁵³ With regular USAAF bombing efforts against Japan, the Allies pressed land and naval forces closer to the mainland. On August 6 and August 9, 1945, B-29s dropped two atomic bombs on Japan contributing to Japan's unconditional surrender.⁵⁴ While the combined efforts from years of campaigns contributed to Japan's surrender, the advent of nuclear warfare fundamentally changed the military paradigm and strategy following World War II.

Arnold helped usher nuclear strategy into the US military and assisted with efforts to preserve nuclear capabilities as an extension of airpower in the wake of World War II. In 1945, Arnold testified before Congress, advocating for nuclear capabilities as a means of retaliation and deterrence.⁵⁵ In 1946, Arnold suffered a heart attack and left the USAAF one year prior to the creation of the USAF.⁵⁶ Throughout his career, Hap Arnold established a force and theory that enabled Allied victories in both World Wars while charting a prudent course for future airpower doctrine and strategy.

Hap Arnold guided America's initial aviation organizations through the World Wars. Throughout his career, Arnold advocated for the air domain to improve American military power. With Arnold's understanding of airpower as a way to mass America's resources to deliver effects and influence an enemy, his resultant theory guided American warfare and directly shaped US military strategy.

Hap Arnold developed means within the US military by linking America's industrial production capability to military requirements in order to mass airpower capabilities. Arnold wrote that aircraft acquisition required deliberate engagement by the military to design and

⁵³ Arnold, *Report of the Commanding General of the Army Air Forces to the Secretary of War*, 95.

⁵⁴ Daso, *Hap Arnold and the Evolution of American Airpower*, 214.

⁵⁵ MacIsaac, *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, 641.

⁵⁶ Yenne, *Hap Arnold*, 275.

mobilize industrial capacity.⁵⁷ Arnold argued that airpower required attack aircraft as well as transport, bombing, reconnaissance, and various echelons of support aircraft.⁵⁸ Establishing these capabilities required comprehensive research and development institutions that Arnold put into place, including the RAND Corporation and the USAF's foundational operational testing and evaluation infrastructure. By deliberately molding the military-industrial relationship between the US Army and civilian industry to support comprehensive air operations, Arnold developed airpower means to galvanize America's burgeoning wartime strategies.

Arnold developed operational ways for the military during World War II and following the war as his theory became foundational to America's Cold War nuclear strategy. During World War II, Arnold's airpower theory directly influenced airpower plans and associated doctrine, including AWPD-1 and AWPD-2, by focusing on massed aviation to achieve strategic effects. As Colin Gray notes, Arnold enabled the US to wage total war in two theaters "because of an absolute human and material strength that enabled strategic dispersion."⁵⁹ Supporting massed aviation required Arnold's advocacy for production mobilization and establishing an air force capable of fully exploiting the air domain. Throughout World War II, Arnold shaped processes within the US military that promulgated airpower options to achieve strategic effects. Following World War II, Arnold's theories influenced the creation of the USAF in 1947 while establishing America's nuclear deterrence strategy at the debut of the Cold War.

Hap Arnold influenced ends development within military strategy by expanding the scope of military objectives and increasing the range of military operations through comprehensive airpower development. During the interwar period, Arnold outlined infrastructure

⁵⁷ Henry H. Arnold and Ira C. Eaker, *Winged Warfare* (New York: Harper & Brothers, 1941), 16.

⁵⁸ *Ibid.*, 17.

⁵⁹ Colin S. Gray, *Airpower for Strategic Effect* (Maxwell AFB, AL: Air University Press, 2012), 206.

and geographic considerations for airpower basing to establish an air force.⁶⁰ Understanding the linkages between technology and airpower, Arnold focused the USAAF efforts to create a long-range bomber and transport service increasing potential objectives for the US military. Arnold expanded the scope of military objectives by linking developments in long-range strategic strike capabilities with corresponding political goals. This expansion saw fruition through the Doolittle Raid and the development of the B-29 leading to America's nuclear strikes on mainland Japan. Arnold oversaw a comprehensive air force development including strategic airlift and various mission sets to increase the range of military operations during World War II. Arnold's actions in developing increased military capabilities directly translated into improved strategic objectives for the US military.

Hap Arnold developed means, ways, and ends within US military strategy to enable a paradigmatic shift with the maturation of airpower during World War II. By linking America's industrial capacity to military resources, Arnold oversaw the maturation of American airpower. Throughout World War I and World War II, Arnold understood the necessity for creating options on the battlefield while massing effects to expand strategic objectives. By intentionally designing American airpower to optimize linkages between capabilities, organizations, and objectives, Arnold prudently influenced US military strategy while establishing the foundation for the USAF.

Colonel John R. Boyd

Colonel John Boyd provides the third case study clarifying the impact of airpower theory on military strategy. John Boyd was only three years old when his father died. His mother raised John and four siblings alone. This early encounter with adversity and poverty shaped Boyd's character in overcoming challenges. Seeking to serve his country and see the world, Boyd

⁶⁰ Arnold and Eaker, *Winged Warfare*, 60.

enlisted in the Air Corps in 1945 and trained as an aircraft turret mechanic before deploying as part of the Japanese occupation force following World War II.⁶¹

After returning from Japan, Boyd attended the University of Iowa and gained his commission in the newly formed USAF with the intent to become a fighter pilot. While in pilot training, Boyd pushed his first aircraft, the T-6 Texan, beyond flight manual restrictions and repeatedly disobeyed training guidelines to exploit the full potential of the airplane. Several times throughout training, Boyd violated orders to conduct cross-country missions and instead joined with other pilots at Luke Air Force Base, Arizona to simulate air combat maneuvers. Boyd's relentless pursuit of becoming a fighter pilot revealed a character of disobedience in order to gain advantages and secure success.⁶²

Following pilot training, Boyd reported for his first assignment flying the F-86 Sabre and rapidly deployed to the Korean War. While in Korea, Boyd honed his understanding of air-to-air combat fundamentals by studying air engagements between the USAF and Soviet-trained pilots near the Yalu River. Throughout the course of the war, 792 enemy aircraft were destroyed while only seventy-eight F-86s were lost by the United States in this region.⁶³ Intrigued by this lopsided ratio, Boyd honed his initial understanding of aerodynamics and the relationship between maneuver and technology as demonstrated by the American pilots in defeating the enemy during the Korean War.

In 1954, when Boyd returned from the Korean War, bomber pilots and nuclear capabilities dominated the USAF's doctrinal focus. During this era, fighter aircraft primarily supported nuclear operations by either intercepting enemy aircraft or escorting friendly

⁶¹ Robert Coram, *Boyd, The Fighter Pilot who Changed the Art of War* (Boston: Little, Brown and Company, 2002), 30.

⁶² *Ibid.*, 45.

⁶³ *Ibid.*, 55.

bombers.⁶⁴ Boyd disagreed with this failure to develop fighter aircraft capabilities in conventional roles and developed an airpower theory to exploit conventional dogfighting potential. After graduating from the Air Force's prestigious Fighter Weapons School, Boyd returned to the school as an instructor where he codified air-to-air combat fundamentals in written form. Boyd authored his first contribution to Air Force tactical doctrine in February 1956 with a treatise on fighter maneuvers. Boyd utilized tactical fighter maneuvers to teach pilots "how to think ... of the effect each maneuver had on airspeed, what countermoves were available to an enemy pilot, how to anticipate those counters, and how to keep enough airspeed to counter the countermove."⁶⁵ Taking personal time when not teaching, Boyd authored the 150-page Aerial Attack Study that became the core Air Force fighter doctrine and earned Boyd the Legion of Merit.⁶⁶

Following his tour at the Weapons School, Boyd attended graduate school at the Georgia Institute of Technology where he combined his airpower background with thermodynamics engineering to author the Energy-Maneuverability Theory.⁶⁷ With his discovery of the Energy-Maneuverability Theory, Boyd derived the relative measurement of energy and maneuverability through uniform comparison of prediction envelopes where one aircraft could outmaneuver another.⁶⁸ With this work, Boyd enabled the cross-comparison of aircraft capabilities, design, acquisition, and performance measurements of military aircraft in the Department of Defense (DoD).

⁶⁴ Coram, *Boyd*, 59.

⁶⁵ *Ibid.*, 76.

⁶⁶ *Ibid.*, 115.

⁶⁷ *Ibid.*, 6.

⁶⁸ Grant T. Hammond, *The Mind of War: John Boyd and American Security* (Washington, DC: Smithsonian Institution Press, 2001), 59.

After Boyd published his Energy-Maneuverability Theory, the Air Force assigned him to the Pentagon where he began work acquiring the USAF's next fighter aircraft. Boyd utilized his Energy-Maneuverability Theory to help design the F-15 Eagle and the F-16 Fighting Falcon as the Air Force's next generation of fighter aircraft. Boyd helped design these fighters to outmaneuver an enemy while providing both air interdiction and close air support capabilities.⁶⁹ Following a brief tour in Vietnam, Boyd retired from the Air Force in 1975. Boyd continued to serve as an advisor to the US government where he continued to refine his airpower and warfare theories.⁷⁰

Employing his understanding of the Energy-Maneuverability Theory as the quantitative relationship inherent to aerodynamics, Boyd derived a qualitative theory on relative maneuver through accelerated decision-making cycles called the Observe, Orient, Decide, Act (OODA) Loop. Boyd applied his tactical expertise to build his theory on operating inside his enemy's decision cycle.⁷¹ Boyd called this his time-based theory of conflict wherein he reduced decision cycles to the four stages of the OODA Loop.⁷² Boyd focused on relative maneuver to operate within an enemy's OODA Loop to paralyze an adversary's decision-making capabilities.⁷³ Boyd argued military force should act relative to a decision-making timeline to paralyze an enemy system.⁷⁴

Between 1975 and his death in 1996, John Boyd served as a military theorist and advisor to the US Air Force, Army, Marine Corps, and to President George H.W. Bush's administration.

⁶⁹ John R. Boyd, "A Discourse on Winning and Losing," presentation, 1987, 4.

⁷⁰ Coram, *Boyd*, 322.

⁷¹ Boyd, "A Discourse on Winning and Losing," 5.

⁷² *Ibid.*, 128.

⁷³ *Ibid.*, 129.

⁷⁴ *Ibid.*, 136.

He worked with the US Army's Training and Doctrine Command to codify its AirLand Battle doctrine and helped rewrite the Marine Corps' FM-1 *Warfighting* doctrine.⁷⁵ During the Gulf War in 1991, Boyd advised Secretary of Defense Dick Cheney and shaped America's strategy in Operation Desert Storm.⁷⁶ When he died in 1996, Boyd left behind a legacy of aviation expansion, organizational change throughout the DoD, and an airpower theory oriented on relative maneuver.

With a broad history ranging from service in Japan following World War II to combat in both Korea and Vietnam, John Boyd's experiences informed his airpower theory of Energy-Maneuverability and the OODA Loop. Boyd believed in optimizing airpower to influence and paralyze an enemy's decision-making cycle through parallel strike and relative maneuver. This theory advocated for feedback processes at tactical, operational, and strategic levels throughout the DoD to gain asymmetric advantages over enemies.

John Boyd developed means within military strategy by influencing aviation design and acquisition processes. Boyd's codification of the Energy-Maneuverability Theory provided a significant departure from previous aircraft designs such as the F-111 Aardvark that sacrificed maneuverability for speed.⁷⁷ Instead, Boyd's aerodynamic theory helped to shift USAF acquisitions in favor of platforms including the F-15 Eagle, the F-16 Fighting Falcon, and the B-1 Lancer. These aircraft disrupted the preferred metric of speed in favor of maneuver.⁷⁸ With his contributions to aviation design and fighter tactics, Boyd revitalized the USAF's fighter arm after decades of focus given to nuclear and bomber mission sets.⁷⁹ Boyd's theory changed the DoD's

⁷⁵ Coram, *Boyd*, 391.

⁷⁶ *Ibid.*, 426.

⁷⁷ *Ibid.*, 206.

⁷⁸ *Ibid.*, 310.

⁷⁹ Gray, *Airpower for Strategic Effect*, 206.

organizational focus as it sought to modernize its materiel, capabilities, and formations at the end of the Cold War. By influencing the Air Force's acquisitions focus and organizational processes, Boyd expanded the USAF's capabilities and means.

The US military developed Boyd's theories into operational ways as military leaders gained understanding of the strategic effects provided by parallel strike that could paralyze an enemy system through relative maneuver. Boyd's theory provided the framework for understanding how to outpace an enemy while targeting vulnerabilities in the enemy's system to gain relative advantage. This theory departed from previous ways of warfare as Boyd's theory provided a new framework for combat that integrated the dimension of time while targeting the enemy's mind instead of a fielded force.⁸⁰ Boyd's qualitative airpower theory, the OODA Loop, directly influenced the creation of AirLand Battle doctrine in the US Army as well as the revised Marine Corps FM-1 doctrine that oriented warfare on friendly and enemy decision cycles.⁸¹ Not only did Boyd's theory inspire new approaches to air operations, it also influenced land and amphibious warfare leading into the post-Cold War era.

In refining military objectives through his relative maneuver theory, Boyd argued for the need to concentrate military strategy on centers of gravity. This concentration of simultaneous effects across the theater is termed parallel warfare.⁸² Parallel warfare is a way within strategy to provide the direct means to influence enemy centers of gravity and generate strategic options. Boyd argued that centers of gravity exist for both friendly and enemy systems wherein leaders derive or issue influence and that these provide targetable vulnerabilities to achieve political

⁸⁰ Boyd, "A Discourse on Winning and Losing," 137.

⁸¹ Frans F.B. Osinga, *Science, Strategy and Warfare: The Strategic Theory of John Boyd* (New York: Routledge, 2007), 256.

⁸² Phillip S. Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetries, and a New Strategic Paradigm* (Annapolis, MD: Naval Institute Press, 2017), 172.

objectives.⁸³ Boyd understood that tactical actions required deliberate linking in time, space, and purpose to achieve political objectives and that an ideal means for influencing the enemy system was through its center of gravity. Boyd's theories developed operational ways to generate strategic options for the US military.

By integrating the dimension of time into the arrangement of tactical actions to achieve political objectives, John Boyd's theory generated changes to end state conditions within military strategy.⁸⁴ By understanding an enemy's OODA Loop, airpower could achieve strategic paralysis by exploiting vulnerabilities in the enemy system and force culmination through parallel attack.⁸⁵ This focus on influencing enemy leadership through military power profoundly shifted America's perception of military objectives. Boyd ultimately expanded options within military strategy and provided a logic for arranging means, ways, and ends in order to accelerate friendly decisions while destroying an enemy.

When qualitatively compared against the evaluation criteria of means, ways, and ends development, John Boyd profoundly influenced US military strategy. While Boyd's career predominantly oriented to the USAF, his theory had significant impacts throughout the DoD. The USAF integrated Boyd's theory into aircraft acquisitions processes and service doctrine as his theory shaped aircraft design as well as tactical employment. Core Air Force service doctrine cites warfare as the dynamic interplay of action and reaction oriented on controlling operational tempo and out-maneuvering an enemy's decision-making cycle as espoused by Boyd's central theory.⁸⁶ John Boyd generated airpower capabilities, expanded military options through his

⁸³ Boyd, "A Discourse on Winning and Losing," 42.

⁸⁴ Ibid., 185.

⁸⁵ Ibid., 137.

⁸⁶ US Department of the Air Force, Air Force Doctrine Document Volume 1 (2015), 39.

theory of relative maneuver to paralyze enemy systems, and fundamentally altered the arrangement of tactical actions to achieve objectives and shift the military paradigm.

Colonel John A. Warden, III

Colonel John Warden provides the final case study clarifying the impact of airpower theory on military strategy. After graduating from the US Air Force Academy and entering the Air Force in 1965, Warden became a fighter pilot.⁸⁷ Early in his career, Warden deployed to the Korean peninsula in response to North Korea's seizure of the United States Ship Pueblo.⁸⁸ During this incident, Warden's squadron rapidly deployed to Korea but arrived to the theater with neither a coherent mission nor a commensurate operational plan. This frustration manifested again, when Warden deployed to Vietnam as a forward air controller. Warden's experiences with the failure to adapt American strategy during the Vietnam War led him to conclude that airpower's misuse during the conflict stemmed from restrictive rules of engagement and limitations placed upon airpower.⁸⁹

Assigned to the Pentagon after the Vietnam War, Warden refined his understanding of airpower capabilities and strategic processes within the US military. In 1975, he worked in the Air Staff's Planning Directorate in the Middle East regional affairs section. Despite the predominant military focus on Cold War affairs, Warden concentrated on complexities in the Middle East and began to formulate potential roles for airpower in future regional conflicts. After his tour at the Pentagon, Warden returned to flying where he progressed through operational leadership echelons. During his time in operations, Warden attempted to hone new capabilities in his units including improved air-to-ground strike capabilities and dissimilar formation operations.

⁸⁷ Mets, *The Air Campaign*, 55.

⁸⁸ John Olsen, *John Warden and the Renaissance of American Air Power* (Washington, DC: Potomac Books, Inc., 2007), 18.

⁸⁹ *Ibid.*, 22.

This training departed from Air Force priorities as the Cold War focus relegated aviation to predominantly defensive counter-air and strategic bombing mission sets.⁹⁰ Warden's operational experiences refined his understanding of the potential role for airpower if unencumbered from the traditional supportive roles taken in the Vietnam War and Cold War.

Following his operational leadership tours, Warden attended the National War College in Washington, DC where he formulated an airpower theory focusing upon the strategic effect the Air Force could make as a supported force.⁹¹ Warden's first thesis, *The Air Campaign: Planning for Combat*, was published in 1988 and presented his ideas for employing airpower to target and manipulate the will of enemy leadership through parallel attack.⁹² Warden believed that airpower provided a unique means to wage warfare with its potential to strike deep into enemy territory attacking enemy vulnerabilities and influencing enemy leadership unlike previous military capabilities.

Warden's theory departs from previous airpower theorists such as Billy Mitchell and Giulio Douhet in that Warden orients air warfare toward political objectives rather than economic concerns.⁹³ The aim of military action in Warden's theory is to manipulate the will of enemy leadership.⁹⁴ In his work, *The Air Campaign*, Warden also argues that since the invasion of Poland in 1939, air superiority was a proven prerequisite for air and ground operations.⁹⁵ As a requirement for subsequent military operations, Warden concludes that the Air Force must shape

⁹⁰ Olsen, *John Warden and the Renaissance of American Air Power*, 95.

⁹¹ John A. Warden, III, *The Air Campaign: Planning for Combat* (Washington, DC: Government Printing Office, 1988), 39.

⁹² *Ibid.*, 53.

⁹³ *Ibid.*

⁹⁴ John A. Warden, III, "The Enemy as a System," *Airpower Journal* 9, no. 1 (Spring 1995), 44.

⁹⁵ Warden, *The Air Campaign*, 13.

the operational environment as a supported force during variable phases of conflict.⁹⁶ Through his air superiority theory, Warden directly shapes the role of airpower in Joint doctrine and argues for heightened primacy by the Air Force in the initial phases of warfare.⁹⁷ This advocacy for employing airpower as the supported force with targeting priorities oriented around the enemy leadership instead of the enemy land force marks a significant departure from prevailing military doctrine during the Cold War.

After his graduation from the National War College in 1988, Warden returned to the Pentagon to work at the strategic planning branch of the Air Staff. As Chief of the Force Assessment Division, called Checkmate, Warden seized the opportunity to test his airpower theory when Iraq invaded Kuwait in 1990.⁹⁸ Warden acted upon his theory of airpower, introducing strategic attack as the basis for the opening actions of Operation Desert Storm.⁹⁹ As the air campaign planner for the operation, Warden applied his theory of action with profound results. On January 17, 1991, American aircraft completely isolated Saddam Hussein's command and control network in forty-eight hours as the opening phases of Operation Desert Storm.¹⁰⁰ The Air Force isolated key leadership from the Iraqi fielded forces through strategic airstrikes achieving total paralysis of the enemy as Warden forecasted. This effective application of Warden's airpower theory established the foundation for subsequent Air Force operations.

Selected as Commandant for the Air Force's Air Command and Staff College, Warden left the Pentagon in 1992 and continued to refine his airpower theory for influencing an enemy

⁹⁶ Warden, *The Air Campaign*, 39.

⁹⁷ Olsen, *John Warden and the Renaissance of American Air Power*, 16.

⁹⁸ Mets, *The Air Campaign*, 56.

⁹⁹ Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (Boston, MA: Houghton Mifflin Company, 1993), 56.

¹⁰⁰ Olsen, *John Warden and the Renaissance of American Air Power*, 1.

system. While serving as Commandant, Warden published his thesis codifying his Five Rings Theory and refocused the school on operational and strategic considerations instead of the tactical applications of airpower.¹⁰¹ Warden believed that airpower could influence enemy centers of gravity as well as linkages within various aspects, or rings of the system. These rings divided into the five categories of enemy leadership, organic essentials, infrastructure, population, and fielded forces.¹⁰² Airpower could paralyze the enemy system by targeting vital linkages between these rings in the enemy system and achieve strategic effects through tactical action. Warden continued refining this targeting model for the Air Force until his retirement in 1995.¹⁰³

John Warden developed means, ways, and ends through his airpower theory to shift military strategy. Through his operational experiences, Warden learned from American conflicts in Vietnam and the Cold War to advocate for airpower as the main effort. Warden captured the necessity of air superiority alongside airpower's strategic ability to influence an enemy system. Understanding Warden's background and airpower theory enables gauging his impact on US military strategy.

Warden developed means within the US military by shifting the tactical focus of fighter aircraft and reorienting the USAF's air operations processes. Warden advocated for precision capabilities that departed from Cold War doctrine and the prevailing focus on nuclear warfare. With these capabilities, Warden also advocated for the Air Force's ability to achieve strategic effects through airpower. Warden shifted airpower's targeting priorities and exploited precision-guided capabilities to expand American military strategy.

Warden developed operational ways to employ airpower within US military strategy by influencing military doctrine and processes to optimize airpower's strategic strike capability and

¹⁰¹ Warden, "The Enemy as a System," 40.

¹⁰² David S. Fadok, *John Boyd and John Warden, Air Power's Quest for Strategic Paralysis* (Maxwell Air Force Base: Air University Press, 1995), 26.

¹⁰³ Olsen, *John Warden and the Renaissance of American Air Power*, 280.

paralyze enemy systems. Prior to the Gulf War, airpower's role predominantly existed either as a means for nuclear warfare or in a supporting role to conventional ground forces. Following the Gulf War and reflecting Warden's influence, the US military developed Joint doctrine to synchronize efforts in time, space, and purpose to achieve political objectives. Joint doctrine reflects Warden's argument that airpower should serve as the main effort during various phases of conflict.¹⁰⁴ The Gulf War demonstrated the role of airpower in enabling the seizure of the initiative for follow-on operations. The US Army abandoned its AirLand Battle doctrine approaching the twenty-first century with the growing reprioritization of air efforts toward strategic targets instead of fielded forces per the obsolete AirLand Battle concepts. Warden argued that influencing the enemy system required flexible airpower to either act alone or in support of another arm of the US military.¹⁰⁵ Warden influenced this reorganization of combat power and priority with the arrangement and resynchronization of military effects within the Joint force construct.

Warden advocated for changes in the phasing of operations to link airpower actions with desired objectives. Gaining air superiority became the primary phase of conflict to enable freedom of action for military operations.¹⁰⁶ With control of the skies, airpower could then leverage its strategic strike capabilities as the supported force to gain the military advantage and target the enemy system directly.¹⁰⁷ Warden's airpower theory articulated the relationship between gaining air superiority and tactically influencing the enemy through phasing and transitions based on events during the conflict. Warden ultimately argued that effective airpower

¹⁰⁴ US Department of Defense, Joint Staff, Joint Publication (JP) 5-0, Joint Operation Planning (Washington, DC: Government Printing Office, 2011), 123.

¹⁰⁵ Mets, *The Air Campaign*, 59.

¹⁰⁶ Warden, *The Air Campaign*, 13.

¹⁰⁷ Warden, "The Enemy as a System," 50.

employment required a deliberate operational approach by arranging capabilities to achieve desired effects.¹⁰⁸ By outlining the role of airpower as both supported and supporting force during various phases of conflict, Warden effectively developed operational ways within military strategy.

Warden's theory expanded operational ways to influence enemy centers of gravity through comprehensive analysis of the enemy system to achieve the strategic paralysis of an enemy. Warden linked airpower's ability to target critical vulnerabilities within enemy nodes through precision attack to paralyze the entire enemy system.¹⁰⁹ Warden's air operations plan during the Gulf War allowed forces to strike critical vulnerabilities in Saddam Hussein's command and control structure therein demonstrating airpower's potential effects in influencing centers of gravity and directly achieving strategic ends through tactical action. Current Air Force doctrine reflects Warden's theory by citing the ways airpower can directly affect the adversary's centers of gravity through strategic attack to influence an enemy's will.¹¹⁰ Warden refined America's post-Cold War military capabilities, enabled the expansion of military end state conditions, and influenced American military strategy.

John Warden developed military ends and objectives by focusing on the strategic application of airpower by the Air Force and shaping the relationship between airpower's tactical actions and strategic effects. When Warden led the Checkmate Division at the Air Staff, he established the doctrinal framework for air operations planning. This reorientation of air doctrine continued with Warden's reconstruction of the Air Command and Staff College's curriculum. Instead of an Air Force limited to tactical theory, Warden challenged airmen to link tactical

¹⁰⁸ Gray, *Airpower for Strategic Effect*, 208.

¹⁰⁹ Warden, "The Enemy as a System," 43.

¹¹⁰ US Department of the Air Force, *Air Force Doctrine Document Annex 3-70, Strategic Attack* (Washington, DC: Government Printing Office, 2017), 2.

actions with strategic effects.¹¹¹ By focusing on end state accomplishment instead of tactical action, Warden fundamentally changed the Air Force's paradigm to improve airpower's application for achieving political objectives.

Warden influenced military strategy through his airpower theory by linking military end state conditions with political objectives, influencing centers of gravity through strategic paralysis, and altering operational phasing to support airpower employment. Warden articulated airpower's improved ability to bypass the terrestrial constraints of historic conflicts and directly influence the enemy system.¹¹² Air Force doctrine reflects Warden's theory by presenting airpower's ability to "simultaneously strike directly at the adversary's centers of gravity, vital centers, critical vulnerabilities, and strategy."¹¹³ This effects-based approach to operations forms the foundational operational approach within Air Force doctrine and operational planning, targeting, and strategy.¹¹⁴ Warden formulated airpower's unique and unprecedented ability to influence the enemy system and achieve political objectives.

Qualitatively comparing Warden's airpower theory to the evaluation criteria of means, ways, and ends development demonstrates John Warden's important role in shaping military strategy. Warden oriented the Air Force toward delivering strategic effects to influence an enemy. The US military modernized its doctrine with the elimination of AirLand Battle following the Cold War and integrated technological developments provided by Air Force platforms. Warden helped overhaul Air Force doctrine as well as its professional military education system as the Joint military force gradually integrated Warden's strategic focus to improve enemy system

¹¹¹ Mets, *The Air Campaign*, 58.

¹¹² Warden, "The Enemy as a System," 47.

¹¹³ US Department of the Air Force, *Air Force Doctrine Document Volume 1* (2015), 29.

¹¹⁴ US Department of the Air Force, *Air Force Doctrine Document Annex 3-0, Operations and Planning* (Washington, DC: Government Printing Office, 2016), 13.

analysis. Warden believed that American military strategy required disruptive advocacy for unique airpower capabilities and abandoning antiquated attachments to obsolete strategies.¹¹⁵ With his advocacy for airpower capabilities, Warden helped shift the military paradigm by demonstrating airpower's direct ability to affect enemy centers of gravity during the Gulf War. This direct linkage between tactical action and strategic effect fundamentally shifted the military paradigm during the Gulf War and spurred changes within the US military. Warden influenced military strategy by linking contemporary technology with refined air operations to achieve unprecedented strategic ends therein shifting the military paradigm at the dawn of the twenty-first century.

¹¹⁵ Warden, *Airpower Applied*, 343.

Chapter 4: Analysis and Conclusion

The case studies of Mitchell, Arnold, Boyd, and Warden exhibit key continuities, unveiling the impact of airpower theorists on the development of military strategy. These case studies demonstrate the relationship between history, theory, and doctrine to understand the context and impact of each theorist. Answering the research question, how did Billy Mitchell, Hap Arnold, John Boyd, and John Warden influence military strategy, requires qualitatively comparing these theorists against the evaluation criteria of means, ways, and ends development. Thomas Kuhn's model for scientific revolution demonstrates trends associated with anomalies within the emerging air domain as individual theorists shifted the US military paradigm. Common trends within these case studies capture the challenges faced by airpower theorists and the difficulties inherent in incorporating emergent domains into military strategy.

Continuities manifest across the four case studies between the theorists, the organizations, and the evolving focus of airpower over time. The four individuals demonstrated passion to the point of disobedience for their airpower views. While Mitchell's insubordination serves as the extreme example of this disobedience, Arnold also lobbied congressional representatives against superior orders. A trend of accepting risk to pursue disruptive airpower capabilities contributed to negative performance reports for both Boyd and Warden as neither leader attained promotion to general officer. This common practice of disobedience, while often at the detriment of personal gain, ultimately enabled these leaders to enact change from within organizations to exploit the air domain and shift the military paradigm.

Mitchell, Arnold, Boyd, and Warden operated within established organizations to achieve airpower capabilities and develop operational ways to leverage airpower. When America entered World War I, Hap Arnold used the crisis to establish the foundation for training, organization, and acquisition for the entire Air Corps in less than a year. Similarly, when Iraq invaded Kuwait in 1990, Warden generated a plan to leverage airpower rather than padlock

American strategy to less effective theory. These airpower theorists employed crises as opportunities to effect change from within their organizations to improve US military operations.

As airpower capabilities developed throughout the twentieth century, the four airpower theorists achieved a gradual shift in air capabilities from a tactical focus to a strategic orientation. Whereas the early use of aviation reinforced ground maneuver, Mitchell's advocacy for strategic strike saw realization during World War II under the leadership of Hap Arnold. Arnold's investment in research and development culminated with the B-29 Superfortress and nuclear capabilities to forge America's Cold War-era military strategy. This focus of affecting strategic objectives through tactical action became the foundation for Boyd's OODA Loop and Warden's Five Rings Theory. The airpower theorists linked aviation capabilities directly to statecraft with the ability to achieve political objectives with feasible and acceptable military means.¹¹⁶

Throughout the twentieth century, airpower theory effectively shifted military focus through the air domain and improved the linkages between tactical actions and strategic objectives.

Answering the Research Question

Analyzing the case studies against the criteria of means, ways, and ends development enables validating the monograph hypothesis and answering the research question, "how did Billy Mitchell, Hap Arnold, John Boyd, and John Warden influence US military strategy?" These four airpower theorists enabled a shift in the military paradigm to alter military strategy in three ways; first, by influencing organizational and doctrinal change throughout the US military; second, by increasing options with airpower capabilities; and third, by demonstrating the role of individual leaders required for shepherding disruptive innovations in emerging domains. Mitchell, Arnold, Boyd, and Warden exploited the air domain by integrating airpower innovations into American military strategy and ultimately influencing the military paradigm.

¹¹⁶ John Andreas Olsen, *Airpower Applied: US, NATO, and Israeli Combat Experience*, ed. John Olsen (Annapolis, MD: Naval Institute Press, 2017), 10.

These four airpower theorists disrupted existing military paradigms and influenced strategy in the US military by increasing options in the operational environment. Each theorist elevated airpower anomalies into crises that forced refinement to military strategy. Mitchell's theory for an independent air force capable of strategic strike promoted phased operations and the ability to strike deep into enemy territory. Arnold developed massed mobilization to expand airpower's capabilities worldwide as the modern Air Force established its global footprint and asymmetric advantage through nuclear action capable of immediate strategic effect. Boyd integrated tempo and the dimension of time into military action as a means to paralyze the enemy. Finally, Warden synchronized air operations planning through deliberate targeting of enemy centers of gravity to influence enemy leadership. These leaders shifted military strategy while increasing the linkages between tactical actions and political objectives.

Shifting military strategy required the comprehensive development of means, ways, and ends. Throughout the case studies, the individual theorist perceived innovative methods for employing airpower means and ways to improve the linkages between technological developments and military capabilities. Instead of constraining airpower to antiquated military objectives, the airpower theorists understood the requirement for a comprehensive shift in the model for establishing military means, ways, and ends to expand strategic purview and capability. The technology did not shift the military paradigm; instead, shifting military paradigms required translation through leadership by the individual theorist into military strategy.

When analyzed through Kuhn's theoretical model for scientific revolutions, the case studies exhibit the requirement for the individual leader to disrupt prevailing paradigms. These anomalies can manifest as new technology, as in the case of Mitchell and Warden, which require an advocate to integrate the capability and gain asymmetric advantage through tactical employment. Anomalies also manifest through novel rearrangement of existing resources, as demonstrated by Arnold when he helped mobilize America's industrial base to mass effects and decisively engage the enemy through the air domain. Anomalies within a new domain also enable

disruption to the entire military system, as exhibited by Boyd when he expanded his theory on gaining relative advantage in dogfighting to understanding decision cycles that ultimately shaped military doctrine and strategy during the Cold War. These four individuals advocated for anomalies that disrupted existing paradigms and fundamentally influenced not only airpower capabilities, but comprehensively altered the military instrument of national power.

The relationship between the air domain and changes in military strategy provides a framework for prudently establishing capabilities in emerging areas such as space, cyberspace, and information domains. Throughout the twentieth century, airpower development brought changes to warfare. Within this growth, however, was the need for theory and leadership to guide the technology and disrupt paradigms by integrating airpower into the military. Emerging domains require disruptive theories and leaders to exploit an anomaly and gain asymmetric advantages.

Exploiting a new domain for military employment requires organizational change, doctrinal development, and an expansion of military strategy to link emerging capabilities with refocused objectives. By comprehensively establishing an organizational structure and materiel acquisitions process, leaders and theorists can ensure an adequate framework exists to suit future needs. Within this framework, leaders within the new domain can analyze capabilities to gain advantages in the new domain. Through organization and doctrine, military leaders can employ technology and guide emerging domains through novel rearrangement of means, ways, and ends to improve military strategy.

Conclusion

Airpower theorists Billy Mitchell, Hap Arnold, John Boyd, and John Warden influenced military strategy by leading technological transformation and expanding military means, ways, and ends to shift the military paradigm and gain asymmetric advantages for the United States. The case studies demonstrate the essential relationship between history, theory, and doctrine that is required to employ technology and transform warfare. The advent of airpower in the early

twentieth century required theorists to analyze the operational environment with new theories in order to leverage emergent technology and shift the military paradigm. The airpower theorists influenced US military strategy by exploiting this new domain, shifting the military paradigm, and ultimately transforming warfare. As the US military continues to seek opportunities in emerging domains, leaders must strive to embrace anomalies and disrupt paradigms like Mitchell, Arnold, Boyd, and Warden to gain asymmetric advantage and galvanize military strategy in the future.

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